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(54) TICKETING SYSTEM

(71) We, INTERNATIONAL BUSINESS MACHINES CORPORATION, a Corporation organized and existing under the laws of the State of New York in the United States of America, of Armonk, New York 10504, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to ticketing systems and in particular to such systems employing ticketing terminals coupled into a system network.

Present ticketing systems may be divided into two general classes. The first of these relates to relatively unsophisticated systems such as those used by most railway companies. Many of these systems employ, at each terminal or booking office, a stock of pre-printed tickets. These tickets may be retrieved either by hand or by semiautomatic selection apparatus. Other systems in this class use blank tickets which are selectively printed using either a printing plate or a coding card which is selected manually. All of these systems suffer from the disadvantage that they require non-automatic reference to tables. Though, at a particular terminal or booking office, the fares and ticket position of the tickets for the most used journeys are known by booking clerks, problems arise when tickets for less frequently taken journeys are requested. This last factor, and also the fact that such systems are largely non-automatic can cause considerable delays in supplying tickets. The second general class relates to reservation and ticketing systems such as those used by major airlines, for example the British Airways BOADICEA system. These are sophisticated systems employing complex communications networks as the majority of the data keyed into a terminal is passed to the central processing system. Such systems are obviously costly and require specially trained operators. The cost is, of course, justified by the speed of operations covering very large areas and the facilities provided, and this speed is necessary with possible conflicts of requests for reservations.

There is a requirement for a system which falls between those in the above classes. Such a system should employ terminals which do not require extensive operator training. It should also employ a centralised control system to permit a limited number of the operations performed by systems within the second class of systems whilst using relatively simple communications facilities.

According to the invention there is provided a ticketing system comprising a host data processing system connected to a plurality of local controllers, each controller being connected to one or more ticketing terminals each comprising a data entry system, a display system and a ticket printer, in which each local controller is operable, in response to selection data from the data entry system of an associated terminal to build sets of data in a buffer storage area in the controller, the data in the sets being derived either by reference to groups of data held within a store connected directly to the controller or, if it is not held therein, by reference to the host system which is operable to obtain the requested data from an associated data storage device for transmission to, and storage at, the local controller, and means, under control of the data entry system, for operating the ticket

printer when a said set of data is fully built up to print this data in the form of a ticket.

In order that the invention can be fully understood, a preferred embodiment thereof will now be described with reference to the accompanying drawings, in which:—

Figure 1 is a block diagram of a ticketing system in accordance with the invention;

Figure 2 shows in more detail a local controller employed in the Figure 1 system;

Figure 3 is a block diagram of the processor employed in a local controller of Figure 2, showing the data flow therein;

Figure 4 shows the coding employed at a local controller as shown in Figures 2 and 3;

Figure 5 is a block diagram of a display unit as used in the data entry and display devices shown in Figure 1; and

Figures 6 to 9 show the display on the screen of a data entry and display device during the operations involved in producing a ticket.

Before describing the preferred embodiment in detail, it should be pointed out that the system will be described with reference to operations within a railway network. It should be understood, however, that such a system could be employed in other environments where there is a requirement for providing similar tickets over a broad area.

Figure 1 is a basic block diagram of a ticketing system. It comprises a host central processing unit 1, this could, for example, be an IBM (registered trade mark) System/370 system. Attached to the host unit is a disc store 2 and a terminal 3. The host unit is connected, through communication links 4, to a plurality of local controllers, only one of which is shown (unit 5). The controller 5 includes a processing and control unit 6, a disc file 7 and storage blocks 8. Each local controller is connected to one or more booking office units, of which two, labelled 9 and 10 respectively, are shown. Normally, each railway booking hall would be supplied with one or more local controllers and each booking window with one booking office unit. Each booking office unit includes one data entry and display unit (11 or 13) together with a ticket printer (12 or 14).

In operation, the host system store 2 holds a set of data blocks called menu pages. These menu pages comprise combinations of pairs of station names in the railway system, routes, valid dates and fare tables. Each local controller contains a subset of the menu pages, this subset comprising the data which will be most used by the attached booking office units.

Initially the clerk presses a key at his terminal, and in response to this the local controller supplies a special initial menu page of data to operate the clerk's display. This page includes the words "ticket", "inquiry", "from here", "from elsewhere", "to Northern Region", "to Southern Region", "1st class single", etc., which are all displayed at appropriate positions next to respective keys on the display/entry unit. If the booking clerk then presses the key next to the displayed word "ticket", then this word is displayed on an area of the display screen which corresponds to the format of a ticket to be printed. The menu page display does not at this time change. The clerk can now press the key next to the "from here" display and the word "Winchester" for example is displayed on the ticket display area. If the clerk then presses the key adjacent the "to Southern Region" display, this causes a new page from the local controller to be displayed. This page provides "to A", "to B", "to C", "to D E", etc., indications on the display, with the ticket display area remaining unchanged. Now, if, for example, a ticket to Weymouth is required, the clerk presses the key adjacent to the "to W" area. This causes a further page from the controller to be displayed. This page provides "to Wareham", "to Warminster", etc., indications on the screen, with, if there are more stations beginning with "W" in the railway system than positions on the display, an "OVER" indication adjacent one of the keys to provide a further page of such station names. The clerk can now depress the button corresponding to "to Weymouth" display area, "to Weymouth" is set into the ticket display area and the local controller again supplies the originally presented page for display. The clerk can now select the required type of ticket, e.g., 1st or 2nd class, single or return, and upon his pressing the appropriate key the full ticket data, including the fare, is presented on the ticket display area. Upon depression of a special PRINT key the local controller data displayed in the ticket display area is transferred to the ticket printer and a ticket having this data printed thereon is produced.

From the above operations, it can be seen that the pages are arranged in a tree structure, with selection of certain items in some pages or selection of any item in other pages causing the selection of new pages in the next level of the tree. In accordance with the information required, a displayed page may be derived directly from a page stored at the local control or, if it is not already stored there, the controller can request it from the host processor.

The host processor's major operation in the subject system is to hold the whole data base of the railway system, initially to supply page data to the local controllers and then to respond to requests for data from the local controllers to retrieve the requested data from its disc storage system and to return this data to the requesting local con-

trollers. As the data base held in store 2 will require fairly frequent updating for, for example, changes in fares, closures of certain routes, the provision of certain special trains, such as football excursions, etc., a terminal 3, termed the commercial manager's terminal is provided. Using this terminal, the manager can make any necessary revisions to the data base, and such revisions can be transmitted to the local controllers at any convenient time. The host processor can perform financial and statistical processing on data collected by the local controllers based on the number of tickets sold, etc. These revision, financial and statistical operations need only involve transfer of the appropriate data between the processor and local controllers at relatively infrequent intervals, for example, once a day. Lastly, a link may be provided between the host processor and a similar host processor of a similar system in a further railway network, for example in a different country. This has the advantage that a combined data base comprising the menu pages for each system is available to both systems.

Figure 2 is a block diagram of a local controller. This comprises a processing unit 20 connected to a read-only control store 21 and a random access memory 22. A disc file 23 is connected to the processor through an adapter 24, and a communications adapter 25 is provided for communications between processing unit 20 and the host processing system. An input/output multiplexor 26 couples processing unit 20 to a plurality of device adapters 27 to 30. Each adapter is connected to an associated one of data entry and display devices 11 and 13 or printers 12 and 14. It should be noted that devices 11 to 14 are relatively simple devices, the printers including only the electromechanical devices, power supplies and connection circuits required for printing, and the data entry and display devices including only decoding and drive circuits for the display device itself together with simple coding arrangements for the entry keys. The essential data organisation for these devices is accomplished by adapters 27 to 30. In operation, processing unit 20 responds to input data from a data entry unit and, under the control of program instructions in read-only store 21 and memory 22, selects pages of data held in memory 22 for transmittal to the data entry and display devices and, when required, to the printers. If the required data is not held in memory 22, then the processing unit generates a page request to the host processing system through communications adapter 25, and it organises the storage of data received from the host in memory 22 either for immediate or future use by the controller. Disc unit 23 is used to hold different types of data. Firstly it can hold statistical data, for example records of the last 100 tickets sold, daily totals of receipts, totals of tickets of different classes, etc., and this data can be used by the local controller to perform accounting operations using this disc file as a journal. Secondly, it can contain re-start procedures for the local controller, and lastly it can act as an intermediate file for data pages received from the host, thereby extending the number of pages which can be retained at the local controller. Processing unit 20 is operable to organise this data storage, to calculate the required sub-totals and to transmit required data, either upon request or at predetermined times, to the host processor.

Figure 3 is a block diagram of processing unit 20, read only store 21 and random access store 22 showing data flow therein. The heart of this unit is an arithmetic and logical unit 40 which receives input data from an input register 42 and applies output data to an output bus 50 through which it is directed either to the read only or random access memories 45 or to a set of working registers 44 or to an input/output multiplexor 43. The ALU also applies control data to the multiplexor 43 through a bus 46. Addressing of the memories 45 and registers 44 is under the control of an address control unit 41, which also receives input data from register 42. Outputs from memories 45 and working registers 44 are fed to register 42 which also receives inputs from multiplexor 43. The multiplexor has an input bus 47, an output bus 49 and a plurality of output control lines 48 connected thereto.

Processing unit operates under the control of a program held partially in the random access memory and partially in read only store. The components of this program are shown in Figure 4. Housekeeping for the system is performed by the system control program 60 which has overall control of an input/output control programe 61. The input/output control program operates the multiplexer in conjunction with an interrupt handler to organise the sequence and timing of input/output operations by the application of adapter control code 63 to the input/output device adapters 64 which include data buffers 70. These buffers hold output data in a form suitable for correct presentation to the attached devices and hold received input data from the data entry units for application into the system in suitable form.

System control program 60 also has overall control of the application code 66 which is in the form of read only micro code. The application code operates to select required sequences of data to be displayed utilising the tree structure of the pages of data which are stored in the random access memory.

The application code also initiates requests for data from the host processor whenever required data is not in the local controller. Storage of pages in the random access memory is under the control of a storage manager program which builds up, and uses for reference, a storage directory 68. The main function of the storage manager is to maintain an updated list of the pages in storage. The application program is also operable to develop state vectors 65, one for each booking office unit. These state vectors include the data to be displayed and printed. They are each divided into two sections, a transaction display area and a menu display area. The transaction area contains data which is built up piece-by-piece during the operations performed by a booking clerk, this data eventually being used to print the ticket. The menu display area contains the data which is displayed for selection by the clerk to build up the ticket buffer data. In addition, the state vectors contain indications of all currently used variables, parameters, flags and pointers which can be used to determine the state of the program operating the booking office units at any time.

Turning now to the display devices used in the data entry and display devices shown in Figure 2, a block diagram of one of these displays is shown in Figure 5. The display is of the gas panel type with discharge sites defined by crossings of row and column drive conductors 80 and 81 respectively. These conductors are driven through respective drive switch units 82 and 83 which are set by row and column select logic circuits 84 and 85 respectively. These circuits receive digital inputs along busses 86 and 87 from buffers in adapter unit 88 which corresponds with one of the adapters 27 or 29 in Figure 2. A high voltage line drive control unit 89 feeds voltages for writing, sustaining or erasing discharges in the panel in response to write or erase signals from adapter 88 along line 90 and applies sustain time reference signals along line 91 back to the adapter. Essentially what happens is that the adapter applies digital input signals from its buffers in appropriate order to the row and column select logic circuits 84 and 85. These decode the digital signals into related line and column signals which operates associated switches in drive switch units 82 and 83. The adapter then initiates operation of drive unit 89 to apply first a write voltage and then a sustaining voltage through the previously selected switches in drivers 82 and 83, via lines 92 and 93, to the selected row and column drive lines. This display system is shown in greater detail in UK Patent Specification No. 1,381,566.

The printers and their adapters are not illustrated herein. The printers are of the well known print wheel type having a plurality of type wheels and associated print hammers and which print a line as a column at a time. In order to permit line printing, data is assembled in the adapters in shift registers which receive this data serially by character. Thereafter, in response to print timing signals from the printer, the data is fed to decoding circuits a line at a time. The decoding circuits control the timing of the firing of the respective print magnets.

A detailed description of operations using the system, including the operation sketched earlier, will follow, but before this, the construction of the menu pages will be explained.

As mentioned above, the system of Figure 1 uses, at the host processing system, data defining the full set of services which the railway is offering to passengers. As each booking office clerk has access only to data in the set, and can not generate his own data, then he can only sell precisely those services. This, of course, tends to minimise errors. At any time, the clerk, through the local controller, must have access to a well defined statement of the services he can sell, this may be called the SYSTEM MENU. Each local controller contains a SYSTEM MENU, which is stored in read-only form and can only be changed when the attached terminals are not in active use. The SYSTEM MENU comprises a plurality of LOGICAL MENU PAGES (LMPs), it should be noted that these LMPs are the "menu pages" mentioned hereinbefore. All of the static data which is needed to sell tickets must initially be coded into LMPs at the host processing system. The LMPs are distributed to the local controllers by paging them individually, for these paging operations, each LMP is indivisible so that each controller only receives complete LMPs.

At the local controllers, the LMPs are interpreted by fixed micro-code. Each is interpreted as a serial code string, the respective elements in the string being termed ITEM CONTROL WORDS (ICWs). ICWs in an LMP are normally interpreted in sequence, though some cause branching to another ICW out of sequence or to another LMP. In a local controller, an LMP is identified by a 32 bit number member and an 8 bit offset identifies one of the 256 words to provide the ICWs. As the ICWs may comprise 1, 2, 3 or 4 words, not all of the combinations of the 8 bit offsets address ICWs, but each ICW is uniquely identified by a concatenation of the LMP number and an offset, i.e., a total of 40 bits.

The ICW format is as follows:—

BIT 0: If this is "1" then the ICW is the last of those that need be executed in an

LMP, if it is "0" then the ICW is not the last.

BIT 1: This is a spare bit.

BIT 2: This indicates a displayable or non displayable ICW. If it is "0", then the ICW is displayable, bytes 4 to 15 contain 16 displayable characters and bits 4 to 7 indicate a transaction buffer area to be used for the displayable characters. The transaction buffer is used to store items for display in the transaction area of the display screen, that is the area in which ticket data is built up and not the menu area adjacent the keys.

If *BIT* 2 is "1", then this indicates that the ICW is a non-displayable ICW of single word length. In this case, bit 3, if "0", indicates that the ICW provides a value, for example a fare value, or if "1" indicates that the ICW may cause a branch. In this case bits 4-7, if they contain "0" indicate a branch to another LMP, bits 8 and 9, if "00" indicate that the branch is unconditional or if "01" indicate a branch if reverse journey. A 'reverse journey' is indicated if a numeric code representing the origin station is greater than a similar numeric code representing the destination station. These numeric codes are arbitrarily assigned to each station in the railway such that each station can be uniquely identified by the code. City pair LMPs are addressed by a pair of numeric codes in ascending value, that is, the lower numeric value first. Thus, if an origin/destination formed by the clerk has the higher value field first, then the system can distinguish this as a 'reverse' journey when compared with the target city pair LMP address. Lastly, bits 10 to 31 are bits 10-31 of the number of the LMP to which a branch should be made.

BIT 3 indicates a class name or end item. If it is "0" then a class name is indicated, bits 8 and 9 indicate the length of the text of the same which can be found in an LMP indicated by bits 10 to 31 of the ICW. If it is "0", then an end item is indicated, in other words it is the last item in a sequence of operations to produce ticket data. In this case, bit 15, if "0" causes the item to be directed to the menu buffer area, or if "1" to the transaction buffer. Bit 14, if "0" indicates that explicit text, defined by bits 8 to 13 is to be displayed, or if "1" indicates that text from a vocabulary table offset in LMP-1 by bits 8 to 13 is to be displayed and bits 16 to 31 indicate further data to be displayed and logical and arithmetic operations to be carried out on data in the transaction buffer. This is the section which controls operations such as fare totalling, adding the date into the transaction buffer, adding validity period of a ticket, etc.

In the system, LMPs are addressed by the 32 bit LMP number which can be constructed in either of two ways. Firstly, when an LMP is called by an ICW (see BIT 2 above) then a 16 bit number (bits 16 to 31 of the LMP number) is used, and these bits are prefixed by 16 bits identifying the railway administration. Alternatively, as a result of a change to the origin or the destination in the transaction buffer, the 16 bit location numbers of the stations in the city pair are concatenated to provide a 32 bit LMP number with the lesser valued station first.

There are a number of fixed LMPs at each local controller, these are as follows:—

LMP-0 is one which is automatically called whenever a booking office unit is reset or the clerk depresses his "MENU" key. This LMP is used as the root of the total system menu tree from which all other menu pages can be located. LMP-1 is a common vocabulary table selected by branching from certain ICWs. It contains commonly encountered texts, such as "SECOND CLASS" and obviates the necessity for these texts to be stored in other LMPs, thus reducing the size of the data base.

LMP-2 to LMP-5 are the roots of the four local subsets of the first booking office unit attached to the local controller. These can be accesed directly by the booking office clerk, without using LMP-0, by depressing his local subset keys. Similarly, four local subset LMPs are used for each other of the booking office units attached to the local controller. These subsets are generated by the clerk building up a transaction and then pressing a "SET BUFFER" key together with the appropriate local subset key, this causes a LOCAL SUBSET GENERATOR microprogram to build up and store the root LMP for the subset.

All LMPs when called, either from the local controller store or from the host processor, are paged to a common transient area which is managed by the storage manager (Figure 4) to determine those which are deleted when the area becomes full. LMPs in the transient area are addressed via a translation table. The format of a translation entry is:—

BITS 0-31 = LMP number
BITS 32-39 = Length of LMP in words
BITS 40-47 = LMP usage count
BITS 48-61 = Real address, on a word boundary, of the LMP in the local controller store.

In order to provide data for a display, a MENU PAGE VISUALISER program is used to control these operations. This interprets the ICWs of a current LMP and moves all, or selected ones, of them into a TRANSACTION BUFFER DISPLAY area in the local controller store and/or into a MENU DISPLAY area of this store. It then invokes the adapter code of the appropriate

data entry and display unit for transmission of the data from the buffers into the associated adapter.

Figure 6 shows the screen of a data entry and display unit having data displayed in the menu area. This data is that derived from LMP-1 when the unit is reset or the MENU key depressed. Other keys shown are the SET BUFFER and SET ITEM keys which are used to set up local subsets in conjunction with local subset keys LS1 to LS4. A PRINT key is operable to transfer built up data corresponding to that displayed on the upper, transaction area of the display, to the printer. A TOTAL key, when operated, causes totalling of fares for a particular number of tickets this has to be depressed both at the start and finish of a totalling operation. The backspace key, BSP allows the booking clerk to retract his path along the menus he has selected whilst at the same time data built up in the transaction buffer is also removed. This, of course, prevents the production of invalid tickets bearing, for example, a first class designation and a second class fare. In addition, his use of the BSP key is restricted within certain attributes associated with the LMP in use, this means he is prevented from going back to a previous display which might contain incompatible fare components. Lastly, sixteen MENU keys are provided adjacent the sixteen display areas in the menu display area. For each selection operation, the clerk presses one of these keys only. We will now go through the selection sequence to produce a ticket from Winchester (the station in which the booking office is situated) to Weymouth, which is in the same region and division (SW) as Winchester.

Firstly, the clerk depresses the menu key against the "ticket" display. This generates a reference to LMP-1 which acts to insert TICKET at the left hand top of the transaction area and to insert a serial number in this area. This data is also stored in the transaction buffer. The menu area at this stage remains unchanged and LMP-1 is still in use. The clerk now presses the key adjacent the "from here" display, this causes an ICW in LMP-1 to refer to the vocabulary to extract "From Winchester" which is displayed underneath "TICKET" in the transaction area and stored in the second line of the transaction buffer. The clerk now presses the key adjacent to the "to SW Division" display. This invokes a class name ICW in LMP-1 which branches to a new LMP in the menu tree, producing a display as shown in Figure 7. The clerk now selects "W", which is also a class name ICW so a new LMP is selected and the display again changes to that shown in Figure 8. If the required station were not on the displayed list, then the clerk could press the key adjacent "OVER" to display further stations beginning with "W", but in this case he selects "to Weymouth". He can now invoke the Winchester/Weymouth city pair LMP which will provide all the remaining information for the ticket. This LMP again causes the menu area display to change and, in fact, revert to that shown in Figure 6. If the clerk now depresses the "2nd Class Return" key, the city pair LMP causes the transfer of data to display this term into the transaction display area and to derive the fare from its fare table and displays the fare. The clerk then depresses the print key, this first causes the current date to be added to the transaction buffer in default of other data and invokes the program to print the data in the transaction buffer as a ticket.

All of the LMPs used in the above operation would normally reside in the local controller. If, however, the Winchester/Weymouth city pair were not stored therein, after reference to the directory, the local controller would request this LMP by its LMP number which, it will be remembered, comprises a concatenation of the numbers of the two stations, from the host system.

As stated hereinbefore, the booking clerk, instead of commencing an operation with the system menu and building up all ticket data step by step, can use a local subject of LMPs to perform a "shorthand" operation. Figure 9 shows an example of an initial display in response to the depression of one of the local subset keys, e.g. key LS1. This accesses the first of a preselected group of LMPs and this LMP places preselected data into the transaction buffer so that this is displayed in the transaction area. The LMP also provides 16 menu items which are displayed in the menu area. The transaction buffer data corresponds to the ticket most often called for at the booking office window, in this case, from Winchester, a second class cheap day return to London (Waterloo). If this ticket is required by the passenger, the clerk depresses the print button which causes the fare, date and serial numbers to be added to the transaction buffer and transaction display, and this data to be printed as a ticket.

The menu items shown on the menu display comprise selected ones of the stations on the main line between London and Bournemouth (this line includes Winchester) and different types of tickets, i.e. first and second class, single and return. Now, if the passenger required, instead of a cheap day return, a first class full fare period return ticket, the clerk would depress the menu key adjacent the 1st class return display, and this causes a corresponding ICW in the LMP to be invoked. This references the appropriate fare data and causes the "2 cl cheap day" data in the transaction

buffer to be replaced by "1 cl return".

If, instead, the passenger wishes to travel to Eastleigh, the clerk depresses the menu key adjacent the "Eastleigh" display. This causes a branch to the Winchester/Eastleigh LMP which, of course, must be in this local subset. The transaction buffer data is now altered by replacing "to Waterloo" by "to Eastleigh" and the clerk can proceed to either immediately print, if a cheap day return ticket is required, or to select a further ticket type as in the case of the Winchester/Waterloo ticket procedure described above.

It can be seen, that the clerk has at his disposal the choice of four local subsets, made available to him by the keys LS1 to LS4. As has been mentioned above, the clerk can build up these subsets himself by menu selection and the use of the SET BUFFER and SET ITEM keys to group the relevant LMPs in the store of the local controller. He can, therefore, select any convenient group of these LMPs. The most obvious one is that described above, relating to the stations on the local line. Other groups may include the major stations in the railway network, e.g. those used in the British Railways "Inter-City" services, or stations on lines which directly connect with the local line.

In summary, therefore, the system comprises a host system connected to a number of local controllers each connected to one or more booking office terminals. The system uses logical menu pages which are stored at the host and can be distributed to, and copied at, the local controllers. The logical menu pages include item control words which can be selected in sequence to build up ticket data. Each booking office clerk can produce a ticket by means of a simple selection procedure from data presented to him on a display. In addition, the clerk can directly select same ticketing data from local subsets of LMPs without going through the normal selection procedures. Thus, each clerk has to hand all of the data required for any tickets in the railway system and in addition has the provision for very rapidly producing the tickets most often required by passengers at his station.

WHAT WE CLAIM IS:—

1. A ticketing system comprising a host data processing system connected to a plurality of local controllers, each controller being connected to one or more ticketing terminals each comprising a data entry system, a display system and a ticket printer, in which each local controller is operable, in response to selection data from the data entry system of an associated terminal to build sets of data in a buffer storage area in the controller, the data in the sets being derived either by reference to groups of data held within a store connected directly to the controller or, if it is not held therein, by reference to the host system which is operable to obtain the requested data from an associated data storage device for transmission to, and storage at, the local controller, and means, under control of the data entry system, for operating the ticket printer when a said set of data is fully built up to print this data in the form of a ticket.

2. A system as claimed in claim 1 in which each local controller includes an arithmetic and logical unit, a data store, and a control store, and each of said groups of data comprises a data page including control data effective to control sequences of operations within the local controllers and data for display at the display systems.

3. A system as claimed in claim 2 in which in each terminal, the display system includes a plurality of individual display areas and the data entry system includes a plurality of data entry devices each positioned adjacent an associated one of the display areas and the data pages are constructed such that said sequences of operations each result in the display of data in at least some of the individual display areas whereby data entered by operation of a data entry device adjacent one of the display areas initiates a further sequence of operations controlled by the control data in the data page causing the display or causes branching to a further data page to provide the next sequence of operations.

4. A system as claimed in claim 3 including decoding means connected to the data entry devices and operable to generate addresses of data pages or portions of data pages in response to operation of the devices.

5. A system as claimed in claim 3 in which each local controller includes a buffer storage area operative to retain portions of the displayed data selected by operation of the data entry devices, said portions corresponding to data to be printed upon a ticket and means operable in response to the operation of a print entry device to transfer data in the buffer storage area to a printer.

6. A system as claimed in any of the previous claims in which each data page comprises a page number and a plurality of control words, at least some of which include data to be displayed and/or printed.

7. A system as claimed in claim 6 in which at least some of the page numbers are formed by the combination of data representing two items of ticket data.

8. A ticketing system substantially as described herein with reference to the accompanying drawings.

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1437883 COMPLETE SPECIFICATION
8 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 1

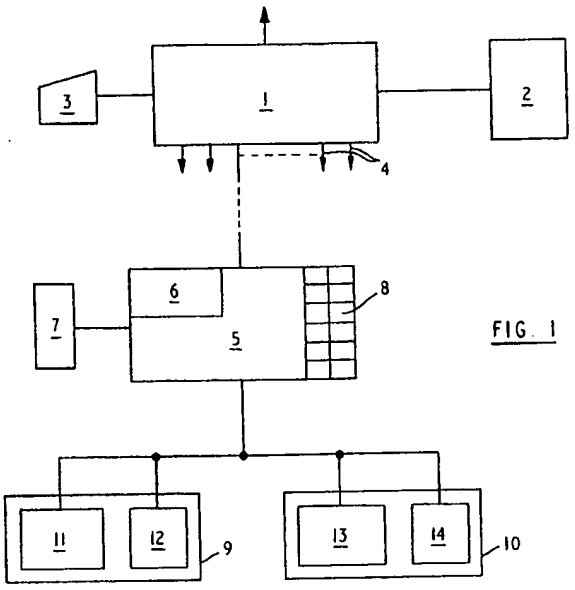

FIG. 1

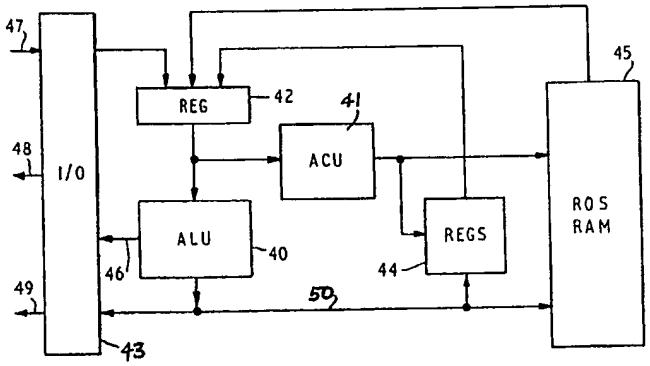

FIG. 3

1437883 COMPLETE SPECIFICATION
8 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

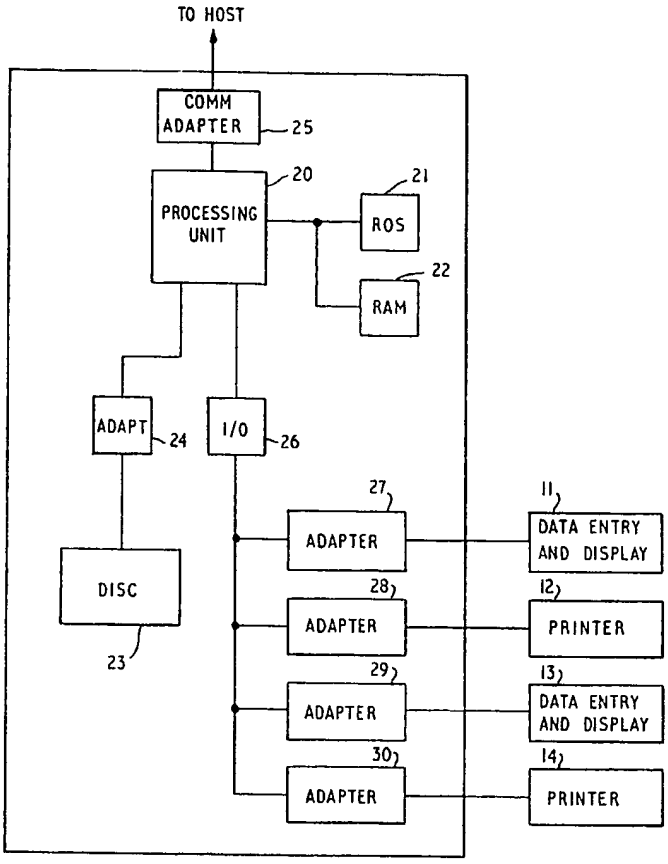

FIG. 2

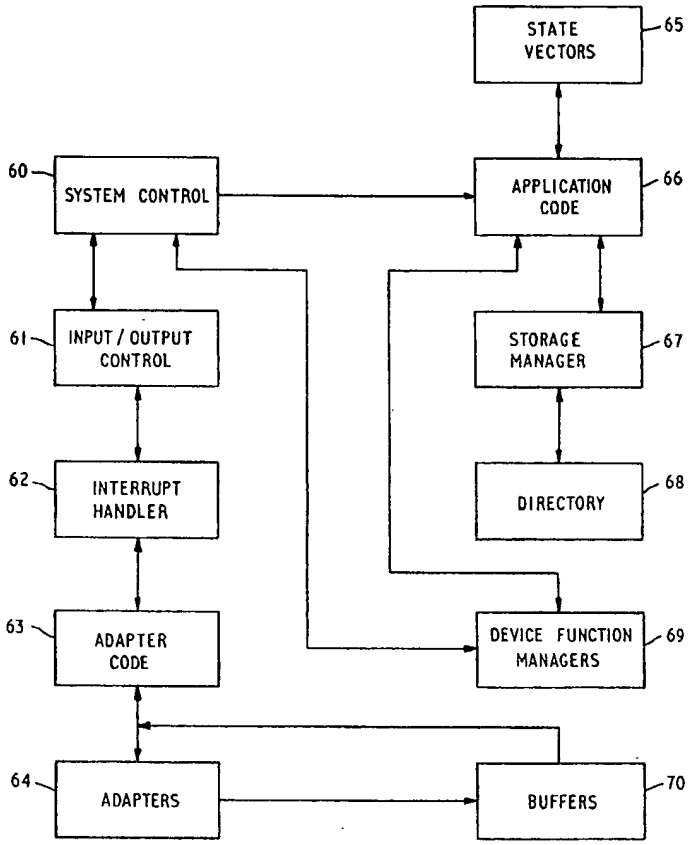
STATE VECTORS
65
60
SYSTEM CONTROL
APPLICATION CODE
66
61
INPUT / OUTPUT CONTROL
STORAGE MANAGER
67
62
INTERRUPT HANDLER
DIRECTORY
68
63
ADAPTER CODE
DEVICE FUNCTION MANAGERS
69
64
ADAPTERS
BUFFERS
70

FIG. 4

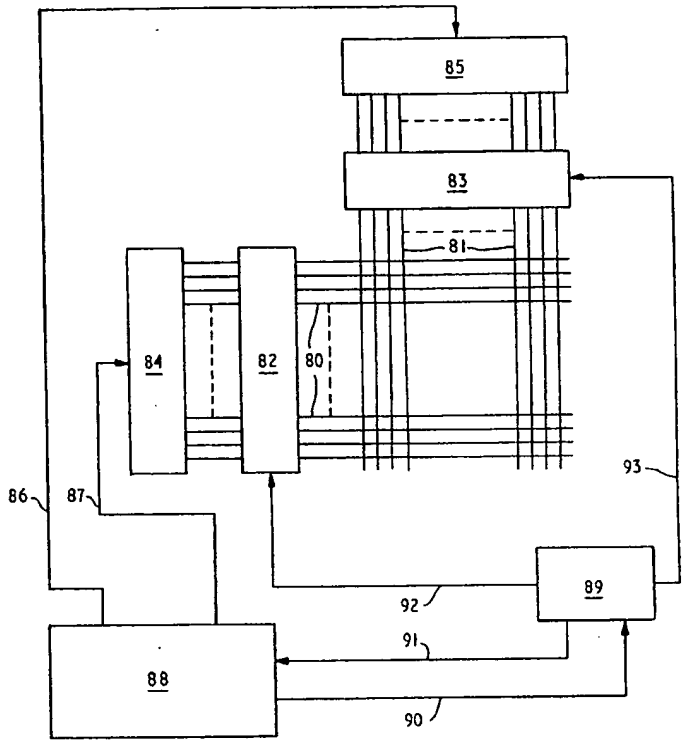

FIG. 5

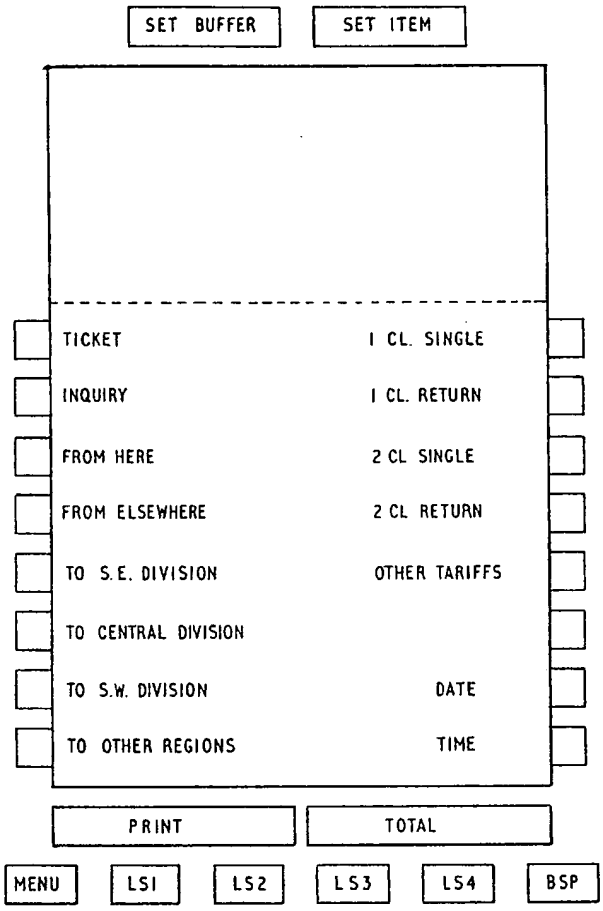
SET BUFFER
SET ITEM
TICKET
INQUIRY
FROM HERE
FROM ELSEWHERE
TO S.E. DIVISION
TO CENTRAL DIVISION
TO S.W. DIVISION
TO OTHER REGIONS
1 CL. SINGLE
1 CL. RETURN
2 CL SINGLE
2 CL RETURN
OTHER TARIFFS
DATE
TIME
PRINT
TOTAL
MENU
LS1
LS2
LS3
LS4
BSP

FIG. 6

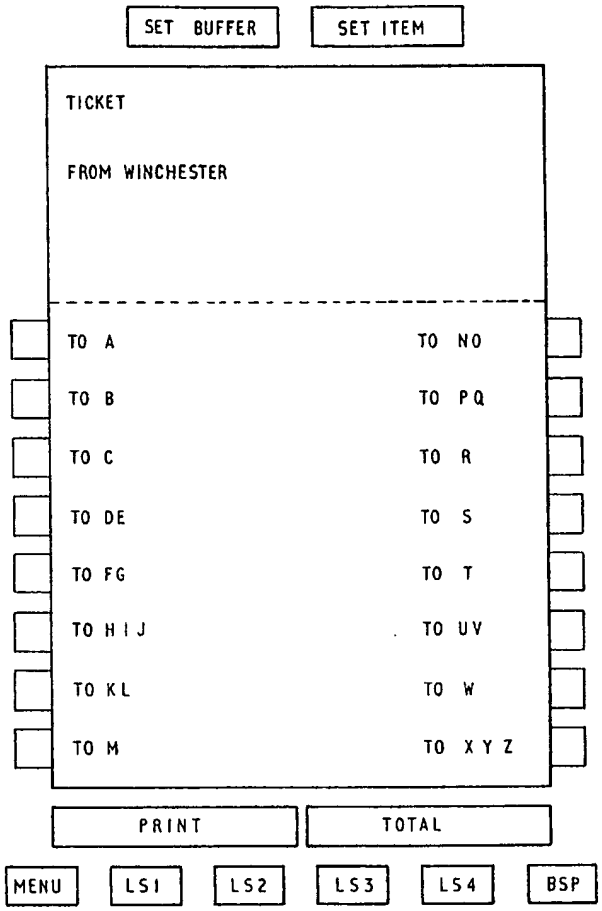
SET BUFFER
SET ITEM
TICKET
FROM WINCHESTER
TO A
TO B
TO C
TO DE
TO FG
TO H I J
TO KL
TO M
TO NO
TO PQ
TO R
TO S
TO T
TO UV
TO W
TO X Y Z
PRINT
TOTAL
MENU
LS1
LS2
LS3
LS4
BSP

FIG. 7

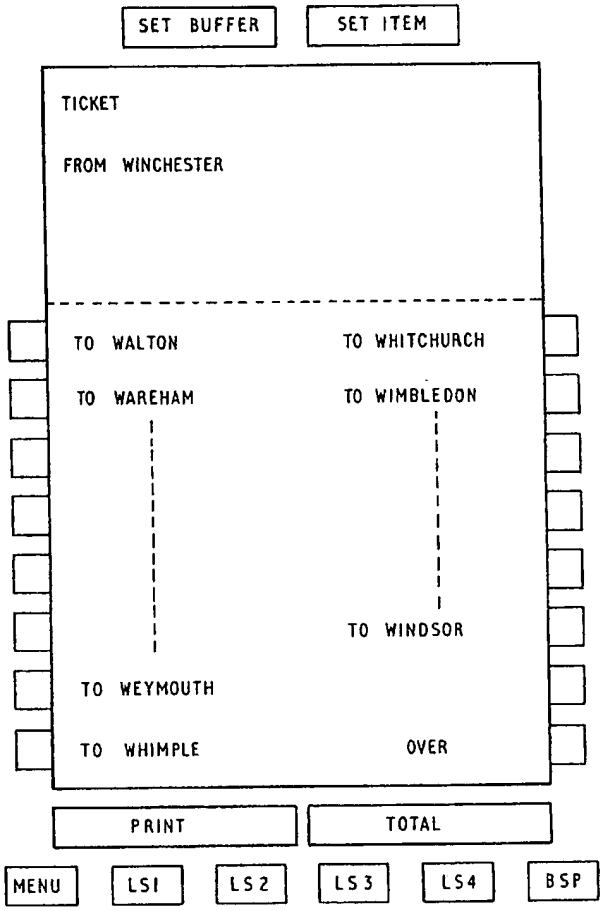
SET BUFFER
SET ITEM
TICKET
FROM WINCHESTER
TO WALTON
TO WHITCHURCH
TO WAREHAM
TO WIMBLEDON
TO WINDSOR
TO WEYMOUTH
TO WHIMPLE
OVER
PRINT
TOTAL
MENU
LS1
LS2
LS3
LS4
BSP

FIG. 8

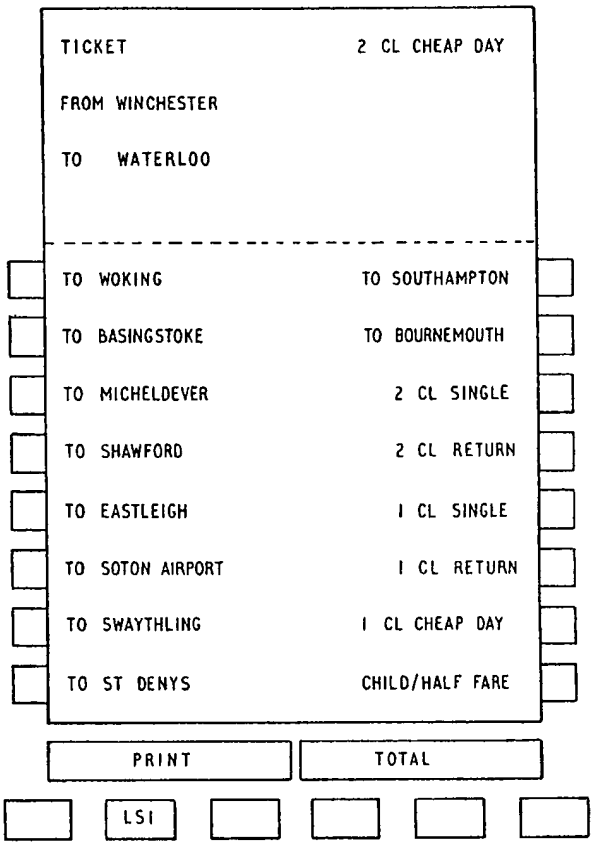
TICKET
2 CL CHEAP DAY
FROM WINCHESTER
TO WATERLOO
TO WOKING
TO SOUTHAMPTON
TO BASINGSTOKE
TO BOURNEMOUTH
TO MICHELDEVER
2 CL SINGLE
TO SHAWFORD
2 CL RETURN
TO EASTLEIGH
1 CL SINGLE
TO SOTON AIRPORT
1 CL RETURN
TO SWAYTHLING
1 CL CHEAP DAY
TO ST DENYS
CHILD/HALF FARE
PRINT
TOTAL
LSI

FIG. 9